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United States Department of Agriculture,

OFFICE OF EXPERIMENT STATIONS.

CANAIGRE.

(*Rumex hymenosepalus.*)

Canaigre is a plant bearing quite a resemblance to some of the more common docks, notably sour dock. The plant grows from 1 to 3 feet high from a cluster of tuberous roots somewhat resembling small sweet potatoes. The stem is rather simple, nearly smooth, and often red. The leaves vary from ovate to lanceolate, and are 2 to 16 inches long, tapering to a short petiole. The flower stalk is branched with compound erect branches; pedicels slender, about half the length of the fruit; fruiting valves membranous, ovate, one-fourth to one-half inch long, pinkish; seed one-eighth to one-fourth inch long. The roots are clustered in an upright position 3 to 12 inches below the surface of the ground. In number they vary from 2 to 15, are 2 to 4 inches long, and an inch or two in diameter, each weighing from 2 to 20 ounces when green. The plant seeds freely, but seems to propagate principally from the roots. When dug the roots may be kept for a year or more without depreciating in value in any way or impairing their germinating power.

FIG. 1.—Canaigre.

TANNIN CONTENT.

The value of the plant consists in the amount of tannin contained in the tubers. Repeated analyses have shown that the tannin content varies from 8.75 to 38 per cent in the air-dried tubers, a quantity far in excess of that in any other of our tannin-producing plants.

The tannin, which is said to be rheo-tannic acid, seems to exist in solution in the cell sap of the roots. The amount varies with the age and size of the root as well as the time of harvesting and soil in which the crop is grown. The following table, compiled from various sources, shows the percentage of tannin contained in the roots grown at various places and dug at different times.

Tannin in canaigre.

	Fresh material.	Air-dried material.		Fresh material.	Air-dried material.
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
California, large roots	9.60	*a* 38.51	Florida, cultivated roots 7 months old		22.50
California, small roots		*a* 41.79	Florida, cultivated roots 12 months old		27.60
California, not selected roots		34.20	Texas, cultivated roots, from wild roots 3 months old		8.80
California, roots dug after flowering		34.12	Texas, cultivated roots, from wild roots 1 year old		30.00
Arizona, roots from hard, sandy soil		22.50	Texas, cultivated roots, Galveston Island, 1 year old		10.80
Arizona, roots from sandy loam		35.60	Texas, cultivated roots, Galveston Island, 2 years old		13.40
Arizona, average roots, 14 localities		30.52	Mexico, wild roots, 6 years old		24.20
Arizona, roots dug June 4, 1892		16.70	U. S. Department of Agriculture, average		23.45
Arizona, roots dug Nov. 16, 1892		24.40			
Arizona, roots dug Jan. 17, 1893		28.20			
Arizona, young roots	3.90	15.10			
Arizona, old roots	10.00	32.00			
Arizona, leaves and stems	0.80	3.90			

a Roots dried at 100 degrees C.

WHERE GROWN.

Canaigre is found growing wild from central Indian Territory to southern Utah and south through Texas, New Mexico, Arizona, and southern California into Mexico. It has been successfully grown for several years in the botanic gardens at Berkeley, Cal. It was also grown in the grounds of the U. S. Department of Agriculture at Washington. Here the plants were not injured by the winter and made a good top growth, but either on account of the soil or the climate the root development was insignificant. Roots received from Arizona September, 1892, had made satisfactory growth at Philadelphia in April, 1893. At various places in New Mexico, Arizona, and elsewhere attempts have been made to grow canaigre under irrigation, with flattering success. Experiments made with canaigre in Florida seem to indicate that the plant will grow well in that State. In Mississippi unsatisfactory attempts have been made to grow the plant. Perhaps in sandy soil it may prove hardy as far north as Kansas and Colorado.

CULTURE.

A good sandy loam, with moderate cultivation is necessary, but equally large crops have been produced on heavy soils where the roots are planted shallow and irrigated. The character of the soil influences the growth and composition of the plant. In general any soil adapted to the growth of sweet potatoes will be found suited to canaigre. Cultivation greatly benefits the crop in that cultivated roots contain less coloring matter and more tannin than wild ones.

Ash analyses made in Texas of one-year-old roots seem to show that canaigre makes a heavy draft upon the potash of the soil, while the amount of phosphoric acid required is comparatively small. The statement is made that in Arizona the amount of nitrogen taken from the soil by canaigre is three times that taken by sugar beets.

The roots are planted in rows 30 inches apart and 10 inches apart in the row, and require about 1 ton of roots per acre. It is estimated that the first season a yield of 10 tons of green roots may be obtained, and the second and succeeding seasons, 15 or even 20 tons. Some growers advise the use of one-year-old roots when planting, while others recommend the planting of old ones. Rather shallow planting is said to give the best results, and the ground should be cultivated enough to keep down the weeds and to keep the soil loose.

In a wild state the plant makes its growth during the winter and early spring, and by June 1 has seeded and the tops are dead. The roots lie dormant until after the winter rains, when the plants make their appearance once more. A short, quick season of growth seems to be necessary for this plant.

In Arizona the time for planting is between September and March. If planted late in the spring leaves will appear and die down at the usual time, and the root will lie dormant throughout the summer, beginning the formation of a new crop at the regular season, with no apparent advantage or disadvantage, as compared with roots planted just before the growing season. In Texas the proper time for planting is said to be between May 15 and September 15, the earlier date being preferred.

The time of harvesting begins after the plant has made its full period of growth, and it has been found that the percentage of tannin increases as the roots lie dormant in the ground, but the increase is very slight after July.

The preparation of the land for planting and the cultivation of the crop are very similar to the methods used for Irish potatoes or other root crops. The cost of cultivating an acre in Arizona is estimated at $16.50, which includes the irrigating and harvesting. In Texas it is claimed that with improved machinery, such as planters, diggers, etc., canaigre can be grown for about $2 per ton of green roots.

PREPARATION FOR MARKET.

As prepared for market the roots are sliced into pieces about one-twentieth to one-fourth of an inch thick and dried in the sun. When thus prepared they lose about two-thirds their weight, and the dried product contains from 10 to 35 per cent tannin.

Where grown upon an extensive scale slicing machines will reduce the cost of the product very considerably, and kiln drying at a temperature of from 120° to 130° F. will be found to give the best results. Care must be taken to avoid all fermentation in the roots, as it will destroy the tannin content. There will also be a loss of the tannic acid if the temperature is allowed to exceed 150° F.

Another method of preparation is the making of an extract from the roots, which contains from 60 to 65 per cent tannin. This extract has been tested by Professor Eitner, of the Vienna (Austria) Research Station for Leather Industry, and others, and pronounced as especially adapted for tanning uppers, fine saddlery, and fancy leather, giving to them a fine finish, color, and durability.

SUPPLY—VALUE.

The supply of wild canaigre is rapidly becoming exhausted. From January 1, 1891, to October 31, 1892, there were shipped to Europe, over the Southern Pacific Railway, 370 car loads of the sliced and dried roots, valued at $40 to $65 per ton. It is said that in New Mexico and Texas the green root is worth about $5 per ton.

Extensive plantations of canaigre have been made in California, Arizona, New Mexico, Texas, and Florida, and from reports from them their financial success seems assured. The crop can hardly be recommended for adoption by farmers of small means on account of the expense of preparation for market, but on a cooperative plan with a central plant for slicing and drying or the manufacture of the extract it would probably give good returns in regions adapted to its growth.

A. C. True,
Director.

Approved:
James Wilson,
Secretary.

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